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(54) WATER-DISINTEGRABLE SHEET

WASSERLÖSLICHES TUCH

FEUILLE POUVANT SE DÉSINTÉGRER DANS L'EAU

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Description

Technical Field

[0001] The present invention relates to a hydrolysable sheet.

Background Art

[0002] Conventionally, reusable wiping cloths made of woven fabrics are used to clean toilets. Recently, however, disposable wet sheets made of paper are used instead. It is preferable that such a wet sheet is provided in a state of being impregnated with a cleaning agent, and can be disposed of by being flushed down a toilet after use. For the disposable wet sheet, the wet paper impregnated with a cleaning agent is required to be strong enough to resist tearing at the time of wiping, and hydrolyzability is required so as not to clog a pipe or the like when being flushed down a toilet. As a technique for effectively achieving these, it is known to use a water-disintegrable sheet, to which a water-soluble binder or the like containing carboxymethyl cellulose (CMC) is added, as base paper (for example, see JP 3865506 B). JP2011-030793A discloses a wet sheet having three layered structure which enables to satisfy both strength and water decomposability. EP1630288A1 relates to a bulky, water-disintegratable cleaning article.

Summary of the Invention

Problem to be Solved by the Invention

[0003] Here, in a case where a hydrolysable sheet impregnated with a chemical solution containing a cleaning agent or the like is used as a wipe, a hydrolysable sheet that suppresses evaporation of water in the chemical solution is desired in order to develop a cleaning effect in work of wiping a target object.

[0004] In view of the above described problem, the present invention has an object to provide a hydrolysable sheet that can suppress evaporation of water in a chemical solution.

Means to Solve the Problem

[0005] The above described problem is solved by the invention recited in claim 1. Preferred embodiments are defined in the dependent claims.

[0006] Claim 11 defines the corresponding method.

Advantage of the Invention

[0007] According to the present invention, it is possible to provide a hydrolysable sheet that suppresses evaporation of water in a chemical solution.

Brief Description of the Drawings

[0008]

Fig. 1 is a plan view illustrating an example of a toilet cleaning sheet according to an embodiment.
FIG. 2A is an enlarged view and a cross sectional view of an embossed part of the toilet cleaning sheet.
FIG. 2B is an enlarged view and a cross sectional view of an embossed part of the toilet cleaning sheet.
FIG. 2C is an enlarged view and a cross sectional view of an embossed part of the toilet cleaning sheet.
FIG. 3A is an explanatory diagram illustrating an example of contact areas of embossments.
FIG. 3B is an explanatory diagram illustrating an example of a contact area of embossments.
FIG. 4 is a flowchart illustrating a method of producing the toilet cleaning sheet according to the embodiment.
FIG. 5 is a schematic diagram illustrating an example of a producing facility (liquid solution adding facility) of the toilet cleaning sheet according to the embodiment.
FIG. 6 is a schematic diagram illustrating an example of a producing facility (processing facility) of the toilet cleaning sheet according to the embodiment.
FIG. 7 is a plan view illustrating another example of a toilet cleaning sheet according to the embodiment.
FIG. 8 is a plan view illustrating another example of a toilet cleaning sheet according to the embodiment.
FIG. 9 is an enlarged view of part A of FIG. 8.
FIG. 10A is an end view taken through B-B of FIG. 9.
FIG. 10B is an end view taken through C-C of FIG. 9.

[Mode for Carrying Out the Invention]

[0009] In the following, a hydrolysable sheet that is an embodiment of the present invention will be described in detail with reference to the accompanying drawings. It should be noted that the scope of the invention is not limited to the illustrated examples.

[0010] It should be noted that for a hydrolysable sheet as the present invention, an example will be described in which the hydrolysable sheet is a toilet cleaning sheet 100. However, other than toilet cleaning sheets, a wet tissue impregnated with a chemical solution for cleaning/wiping is included as the hydrolysable sheet of the present invention. Further, a conveying direction of paper at the time of producing the toilet cleaning sheet 100 is described as the Y direction (longitudinal direction), and a direction perpendicular to the conveying direction is described as the X direction (lateral direction).

<Configuration of the toilet cleaning sheet 100>

[0011] First, a configuration of the toilet cleaning sheet 100 will be described. The toilet cleaning sheet 100 is obtained by applying a ply process to (obtained by stack-

ing) a plurality of sheets (two sheets, for example) of base paper, and is impregnated with a predetermined chemical solution. Further, as illustrated in FIG. 1, an embossing process is applied to the entire sheet surface of the toilet cleaning sheet 100 to have two types of embossments EM11 and EM12. It should be noted that it is preferable that a contact area generated between an object to be cleaned up or the like and the two types of embossments EM11 and EM22 is preferably 15 mm^2 to 30 mm^2 per 100 mm^2.

[0012] For example, unevenness of wiping can be reduced by arranging the embossments EM11 in rhomboid grids, in comparison with a case in which the embossments EM11 are arranged in square grids or rectangular grids. Further, the embossments EM12 are arranged between the embossments EM11.

[0013] Further, a folding process is applied to the toilet cleaning sheet 100 to be folded in two at the central portion in the longitudinal direction (Y direction). Then, the toilet cleaning sheet 100 is stored, in a folded state, within a plastic case, a packaging film, or the like for storage, and, at the time of being used, is unfolded as needed to be used. It should be noted that a way of folding the toilet cleaning sheet 100 is not limited to folding it into two, but may be folding it into four or folding it into eight, for example.

[0014] Further, the toilet cleaning sheet 100 of the embodiment is composed of a hydrolysable fiber assembly such that after cleaning a toilet, the toilet cleaning sheet 100 can be discarded in the water tank of the toilet bowl.

[0015] A fiber obtained by mixing leaf bleached kraft pulp (LBKP) with needle bleached kraft pulp (NBKB) is used as the fiber assembly. A preferable fiber material has a compounding proportion of leaf bleached kraft pulp to components of the fiber material material fiber greater than 50% by weight. That is, a fiber of which a compounding ratio of needle bleached kraft pulp to leaf bleached kraft pulp is less than 1/1 is preferable. A more preferable material fiber has a compounding proportion of leaf bleached kraft pulp to the components of the material fiber greater than 60% by weight. That is, a fiber of which a compounding ratio of needle bleached kraft pulp to leaf bleached kraft pulp is less than 2/3 is more preferable. By increasing a compounding ratio of leaf bleached kraft pulp with respect to needle bleached kraft pulp, clearances between the fibers can be decreased and evaporation of water in the chemical solution can be suppressed. Further, in order to enhance the strength of a base paper sheet that is a base material of the toilet cleaning sheet 100, carboxymethyl cellulose (CMC) is applied, as a paper strength enhancing agent, to the base paper sheet. More specifically, CMC is applied such that a content of CMC increases from inside towards the front surface and the back surface in a thickness direction of the base paper sheet.

[0016] Further, the toilet cleaning sheet 100 of the embodiment is impregnated with a predetermined chemical solution. Specifically, the predetermined chemical solution contains auxiliary agents such as a perfume, a preservative agent, a sterilizing agent, a paper strength enhancing agent, and an organic solvent, in addition to an aqueous cleaning agent. It is preferable that, with respect to a weight of the base paper sheet that is the base material of the toilet cleaning sheet 100, the base paper sheet is impregnated with the predetermined chemical solution at 150% to 300% by weight.

[0017] Any appropriate chemical solution may be used as the predetermined chemical solution. For example, in addition to a surfactant, a lower or higher (aliphatic) alcohol can be used as the aqueous cleaning agent. As the perfume, in addition to an aqueous perfume, one or several kinds can be selected from among oily perfumes such as orange oil. As the preservative agent, parabens such as methylparaben, ethylparaben, or propylparaben can be used, for example. As the sterilizing agent, benzalkonium chloride, chlorhexidine gluconate, povidone iodine, ethanol, cetyl benzanium oxide, triclosan, chloroxylenol, isopropylmethylphenol, or the like can be used, for example. As the paper strength enhancing agent (cross-linking agent), boric acid, various metal ions, or the like can be used. As the organic solvent, a polyhydric alcohol such as glycol (dihydric), glycerin (trihydric), or sorbitol (tetrahydric) can be used. In the toilet cleaning sheet 100 of the embodiment, at least a polyhydric alcohol that is a trihydric or higher alcohol such as glycerin or sorbitol is used as the organic solvent. Thereby, it becomes possible to enhance the viscosity of the chemical solution to be added into the base paper sheet and to suppress evaporation of water included in the chemical solution. It is preferable that, with respect to the weight of the base paper sheet, the base paper sheet is impregnated with this trihydric or higher alcohol at 1% to 20% by weight. In order not to decrease a yield rate due to excessive enhancement of the viscosity of the chemical solution, the upper limit of this content rate is 20% by weight.

[0018] Further, the auxiliary agents of the components of the chemical solution described above can be appropriately selected and a component for satisfying another function may be contained in the chemical solution as needed.

[0019] As illustrated in FIG. 2A, a protruding part PR21 of each embossment EM11 has a curved surface shape.

[0020] Further, as illustrated in FIG. 2B, a protruding part PR22 of each embossment EM12 has a planar shape.

[0021] Because the embossments EM12 are arranged between the embossments EM11, the protruding parts PR21 of the embossments EM11 and the protruding parts PR22 of the EM12 are close to cohere, and thereby, a conjoined embossment EM 21 is formed as illustrated in FIG. 2C. Alternatively, the protruding parts PR21 of the embossments EM11 and the protruding parts PR22 of the embossments EM12 may be simply close to each other without being conjoined.

[0022] By the two types of embossments EM11 and

EM12 formed in this manner, a contact area with an object to be cleaned or the like can be increased. Therefore, hardness of the toilet cleaning sheet 100 is eased and the wiping performance is enhanced.

[0023] That is, by forming in combination, on the entire sheet surface of the toilet cleaning sheet 100, the embossments EM11 each of which has the protruding part PR21 with the curved surface and the embossments EM12 each of which has the protruding part PR22 with the planar surface, the contact area is increased only after each embossment is deformed when force is applied to the toilet cleaning sheet 100 at the time of wiping. Thus, as well as increasing the contact area, flexibility is also enhanced as a result of the deformation of each embossment.

[0024] For example, as illustrated in FIG. 3A, in a case where only the embossments EM11 are formed, contact areas CN31 generated by deformation of the embossments EM11 caused by force applied to the toilet cleaning sheet 100 at the time of wiping work discretely occur adjacent to the embossments EM11. On the other hand, in a case where the two types of embossments EM11 and EM12 are used in combination, as illustrated in FIG. 3B, a contact area CN32 generated by deformation of the embossments EM11 and EM12 caused by force applied to the toilet cleaning sheet 100 at the time of wiping work is increased in comparison with the contact areas CN31 of FIG. 3A.

[0025] Further, by the two types of embossments EM11 and EM12, effects of normal embossments can be similarly obtained, and texture, absorbability, bulkiness, and the like of the toilet cleaning sheet can be enhanced. Furthermore, by the conjoined embossment EM21, a good appearance effect based on applying the embossments can be obtained similar to normal embossments.

[Method of producing the toilet cleaning sheet 100]

[0026] Next, a method of producing the toilet cleaning sheet 100 will be described. FIG. 4 is a flowchart illustrating the method of producing the toilet cleaning sheet 100. FIG. 5 is a schematic diagram of a liquid solution adding facility that adds, to the base paper sheet of the toilet cleaning sheet 100, a binder solution containing a water-soluble binder. FIG. 6 is a schematic diagram of a processing facility that processes the base paper sheet to which the binder solution has been added by the solution adding facility illustrated in FIG. 5.

[0027] In the method of producing the toilet cleaning sheet 100, as illustrated in FIG. 4, first, a papermaking process (S1) is performed by a papermaking machine (not illustrated) to prepare paper as base paper.

[0028] Next, as illustrated in FIG. 4 and FIG. 5, in the solution adding facility, a ply process (S2) to obtain a ply continuous sheet 1B is applied to continuous dry base paper 1A and 1A respectively fed from a plurality of (two, for example) primary web rollers 1 and 1, around which the prepared base paper is wound. A solution adding process (S3) is performed to add the binder solution to the ply continuous sheet 1B to obtain a continuous sheet 1C. A drying process (S4) is performed to dry the continuous sheet 1C. A slitting/winding process (S5) is performed to slit and wind the dried continuous hydrolysable sheet 1D. It should be noted that the number of primary web rollers may be changed as appropriate if the number is two or more. In the following description, an example will be described in which two rollers are used.

[0029] Next, as illustrated in FIG. 4 and FIG. 6, in the processing facility, an embossing process (S6) is performed to emboss the continuous hydrolysable sheet 1D, wound in the above described slitting/winding process (S5) and fed from a secondary web roller 11. A finishing process (S7) is performed to finish the embossed sheet 1E, to which the embossing process has been applied. Note that each of the processes will be described in detail later below.

(Papermaking process)

[0030] The papermaking process according to the present invention will be described. In the papermaking process of the present invention, for example, a papermaking material is used by a known wet type papermaking technique to form the base paper sheet. That is, after wetting the papermaking material, the material is dried by a dryer or the like to form the base paper sheet such as tissue paper or crepe paper. As a material of the base paper sheet, for example, known virgin pulp, recycled paper pulp, or the like may be used, and at least a pulp fiber is included. In particular, pulp obtained by mixing LBKP with NBKP in an appropriate proportion is suitable for the pulp to be the material. It should be noted that a rayon fiber, a synthetic fiber, or the like may be contained as a fiber other than the pulp fiber. Further, the base paper sheet of the present invention contains, as a flocculant, an anionic acrylamide-type polymer (referred to as the "anionic PAM" in the following). The anionic PAM is a polymer obtained by copolymerizing an acrylamide-type monomer and an anionic monomer. The acrylamide-type monomer is acrylamide alone, or a mixture of acrylamide and a nonionic monomer, as follows, copolymerizable with acrylamide. Examples of the nonionic monomer copolymerizable with acrylamide include methacrylamide, N, N-dimethylacrylamide, N, N-diethylacrylamide, N-isopropylacrylamide, N-isopropylcrylamide, N-hydroxyethylacrylamide, diacetone acrylamide, acryloylmorpholine, N-acryloylpyrrolidine, N-acryloylpiperidine, N-vinylrolidone, N-vinylformamide, and N-vinylacetamide. One of them may be used or two or more kinds may be used in combination. Examples of the anionic monomer include acrylic acid, methacrylic acid, acrylamide-2-methylpropanesulfonic acid, itaconic acid, maleic acid, fumaric acid, and neutralized salts thereof. It should be noted that a monomer such as styrene, acrylonitrile, or (meth) acrylic acid ester may be blended as

long as it does not impair the water solubility of the anionic PAM. It is preferable that an additive amount of the anionic PAM is approximately 10 ppm to 1000 ppm. By using such an anionic flocculant having an electric charge that is the same as that of pulp to make paper, the flocculation of the base paper sheet can be decreased and the hydrolyzability can be enhanced by a capillary action. It should be noted that in addition to the flocculant and pulp described above, chemicals for papermaking such as a wet paper strength agent, an adhesive agent, and a remover may be used as appropriate in the base paper sheet.

(Continuous dry base paper)

[0031] It is preferable that the continuous dry base paper 1A has, as a physical property, a basis weight approximately of from 15 gsm to 75 gsm. Further, a basis weight of the sheet (the continuous hydrolysable sheet 1D), containing the water-soluble binder, to which the ply process has been applied is approximately of from 30 gsm to 150 gsm. It should be noted that the basis weight is based on the standard of JIS P 8124. The continuous dry base paper 1A becomes, through the ply process (S2), the solution adding process (S3), the drying process (S4), and the slitting/winding process (S5) that are described later below, hydrolysable paper, to which the ply process has been applied, and the hydrolysable paper is processed into the toilet cleaning sheet 100 through the embossing process (S6), and the finishing process (S7) that are described later below.

(Ply process)

[0032] Next, the ply process (S2) of the embodiment will be described. In the ply process (S2), as illustrated in FIG. 5, the ply process is applied to the respective continuous dry base paper 1A and 1A, continuously fed from the web rollers 1, along the continuous direction, and the continuous dry base paper 1A and 1A are supplied to an overlapping part 2 to make the ply continuous sheet 1B. The overlapping part 2 is composed of a pair of rolls and applies the ply process to the respective continuous base paper 1A and 1A to form the ply continuous sheet 1B, to which the ply process has been applied. Note that when the continuous dry base paper 1A and 1A are overlapped with each other, the continuous dry base paper 1A and 1A may be lightly fastened by pin embossments (contact embossments) so as not to misalign the continuous dry base paper 1A and 1A.

(Binder solution)

[0033] Next, the binder solution will be described. The binder solution contains carboxymethyl cellulose (CMC) as a water-soluble binder. The concentration of carboxymethyl cellulose in the binder solution is 1% to 30% by weight. The concentration is preferably greater than or equal to 1% and less than 4% by weight.

[0034] A degree of etherification of CMC is preferably 0.6 to 2.0, is more preferably 0.9 to 1.8, and still more preferably 1.0 to 1.5. This develops excellent hydrolyzability and wet paper strength.

[0035] Further, water swellable material may be used as CMC. This enables, through cross-linking a specific metal ion in the chemical solution, to exert a function to keep an un-swelled fiber constituting the sheet and to impart strength as a wiping sheet to withstand cleaning/wiping work.

[0036] A component other than carboxymethyl cellulose included in the binder solution is a binder component such as polyvinyl alcohol, starch or a derivative thereof, hydroxypropyl cellulose, sodium alginate, tranth gum, guar gum, xanthan gum, gum arabic, carrageenan, galactomannan, gelatin, casein, albumin, purplan, poly ethylene oxide, viscose, polyvinyl ethyl ether, sodium polyacrylate, sodium polymethacrylate, polyacrylamide, a hydroxylated derivative of polyacrylic acid, or a polyvinyl pyrrolidone/vinyl pyrrolidone vinyl acetate copolymer.

[0037] It is preferable to use a water-soluble binder including a carboxyl group in terms of having suitable hydrolyzability and developing wet strength by a cross-linking reaction. The water-soluble binder including the carboxyl group is an anionic water-soluble binder that easily generates a carboxylate within water. An example of the binder is a polysaccharide derivative, a macromolecule, or a natural product. The polysaccharide derivative may be a salt of carboxymethyl cellulose, carboxyethyl cellulose or a salt thereof, carboxymethylated starch or a salt thereof. In particular, an alkali metal salt of carboxymethyl cellulose is preferable.

[0038] The synthetic macromolecule may be a salt of a polymer or a copolymer of unsaturated carboxylic acids, a salt of a copolymer of an unsaturated carboxylic acid and a monomer copolymerizable with the unsaturated carboxylic acid, or the like. The unsaturated carboxylic acid may be acrylic acid, methacrylic acid, itaconic acid, crotonic acid, maleic anhydride, maleic acid, fumaric acid or the like. The monomer copolymarizable with these unsaturated carboxylic acids may be an ester of these unsaturated carboxylic acids, vinyl acetate, ethylene, acrylamide, vinyl ether, or the like. As the synthetic macromolecule, a macromolecule that uses acrylic acid or methacrylic acid as an unsaturated carboxylic acid is particularly preferable. Specifically, polyacrylic acid, polymethacrylic acid, a salt of a copolymer of acrylic acid and methacrylic acid, or a salt of a copolymer of acrylic acid or methacrylic acid and alkyl acrylate or alkyl methacrylate is particularly preferable. The natural product may be sodium alginate, xanthan gum, gellan gum, tragacanth gum, pectin or the like.

(Solution adding process)

[0039] Next, the solution adding process (S3) of the embodiment will be described. In the solution adding

process (S3), as illustrated in FIG 5, the above descried binder solution is sprayed from respective two-fluid-type spray nozzles 3 and 3 on both external surfaces of the ply continuous sheet 1B (surfaces for which the continuous dry base paper 1A and 1A do not face each other at the time of applying the ply process to the continuous dry base paper 1A and 1A). In this way, the water-soluble binder included in the binder solution can be added to the ply continuous sheet 1B. It should be noted that as a method of spraying the binder solution, for example, immediately after the respective two-fluid-type spray nozzles spray the above described binder solution to the external surfaces of sheets of the respective continuous dry base paper 1A and 1A fed from the above described primary web rollers 1 and 1 (to surfaces that the respective sheets do not face), a ply process may be applied to the continuous dry base paper 1A and 1A so as to generate a sheet equivalent to the above described continuous sheet 1C.

[0040] Each of the two-fluid-type spray nozzles 3 is a type of a spray nozzle that mixes and sprays liquid and compressed air divided into two systems, and is able to finely and uniformly spray liquid relative to a single-fluid-type spray nozzle that singly sprays compressed liquid. In a case where two-fluid-type spray nozzles are used in the embodiment, because the two-fluid-type spray nozzles apply, at a high pressure (spraying pressure that is higher than or equal to 1.5 MPa), the binder solution (having viscosity of 400 MPa.s to 1200 MPa.s) to each of the external surfaces of the ply continuous sheet 1B to which the ply process has been applied, the binder solution is easily added in the thickness direction of the sheet. In contrast, in a case where single-fluid-type spray nozzles are used in the embodiment, the single-fluid-type spray nozzles apply, at a spraying pressure lower than or equal to 1.5 MPa, the binder solution (having viscosity of 400 MPa.s to 1200 MPa.s) to each of the external surfaces of the ply continuous sheet 1B to which the ply process has been applied, whereby the binder solution is easily added in the thickness direction of the sheet, and the binder solution is uniformly applied to the sheet surfaces.

(Drying process)

[0041] Next, the drying process (S4) of the embodiment will be described. In the drying process (S4), as illustrated in FIG. 5, insoluble liquid components in the binder solution of the continuous sheet 1C described above are evaporated by the drying facility 4 to fix active components, CMC in particular, to the fiber. Here, because the impregnation amount of the binder solution decreases towards inside from the external surfaces (the front surface and the back surface) of the continuous sheet 1C in the thickness direction, the fixation amount of CMC decreases towards inside in the thickness direction. Hence, when the chemical solution is added in the finishing process (S7) that will be described later below, towards inside in the thickness direction, a cross-linking reaction is less likely to occur and voids increase, and therefore the chemical solution can be trapped inside the sheet. Thereby, it is possible to obtain the toilet cleaning sheet 100 that does not easily dry. Further, because a large amount of cross-linking reactions of CMC occur in the vicinities of the external surfaces of the continuous sheet 1C, it is possible to strengthen the surface strength of the obtained toilet cleaning sheet 100. As the drying facility 4, a dryer facility with a hood that supplies hot air to the continuous sheet 1C to dry the continuous sheet 1C can be used. It should be noted that, in order to cause the sheets to more firmly adhere to each other, pressing rollers or turning rollers may be installed and then the continuous sheet 1C is passed through the pressing rollers or the turning rollers before the drying process (S4).

[0042] Further, as the drying facility described above, a facility that emits an infrared ray may be used. In this case, a plurality of infrared ray emitting parts are arranged in parallel in the conveying direction of the above described continuous sheet 1C, and infrared rays are emitted to the conveyed continuous sheet 1C to dry the sheet 1C. Because water is heated and dried by the infrared rays, the sheet can be uniformly dried and generation of wrinkles in the subsequent slitting/winding process can be prevented relative to a dryer using hot air.

(Slitting/winding process)

[0043] Next, the slitting/winding process (S5) of the embodiment will be described. In the slitting/winding process (S5), in order to obtain a web for when the continuous hydrolysable sheet 1D, to which the ply process has been applied, is processed by an off-line processing machine, while tension of the continuous hydrolysable sheet 1D, dried in the above described drying process (S4) and to which CMC has been fixed, is adjusted, the sheet is slit by a slitter 5 at a predetermined width and wound in a winder facility 6. A winding speed is appropriately determined in consideration of the ply process (S2), the solution adding process (S3), and the drying process (S4). It should be noted that if the winding speed is too fast, the sheet may break, and if the winding speed is too slow, the sheet may wrinkle. In the slitting/winding process (S5), the continuous hydrolysable sheet 1D, to which the ply process has been applied, is pressure-joined such that the continuous hydrolysable sheet 1D is further unified to be a single sheet.

(Embossing process)

[0044] Next, the embossing process (S6) of the embodiment will be described. In the embossing process (S6), as illustrated in FIG. 6, the continuous hydrolysable sheet 1D, fed from the secondary web roller 11, is embossed by embossing rollers 12 to form predetermined shapes on the entire sheet surface. The sheet is embossed in order to enhance design quality as well as to enhance strength, bulkiness, wiping performance, and

the like of the sheet.

(Finishing process)

[0045] Next, the finishing process (S7) of the embodiment will be described. In the finishing process (S7), as illustrated in FIG. 6, a series of processes, which include a process of cutting the embossed sheet 1E, a process of folding the respective cut sheets, impregnating the respective folded sheets with the above described chemical solution, and packaging the respective sheets impregnated with the above described chemical solution, are performed in a finishing facility 13. Here, it is preferable to use a polyvalent metal ion in the cross-linking agent included in the chemical solution, in a case where CMC is used as the water-soluble binder. In particular, it is preferable to use one kind or two or more kinds of polyvalent metal ions selected from among the group consisting of alkaline earth metals, manganese, zinc, cobalt, and nickel, in terms of sufficiently bonding the fibers to develop strength for withstanding use and of having sufficient hydrolyzability. It is particularly preferable to use ions of calcium, strontium, barium, zinc, cobalt, and nickel among these metal ions. As described above, through the respective processes, the toilet cleaning sheet 100 is produced.

[0046] As described above, according to the embodiment, by increasing a compounding ratio of leaf bleached kraft pulp with respect to needle bleached kraft pulp such that a compounding ratio of needle bleached kraft pulp to leaf bleached kraft pulp is less than 1/1, gaps between the fibers can be decreased and evaporation of water in the chemical solution can be suppressed. Further, because a trihydric or higher alcohol is added at 1% to 20% by weight with respect to the weight of the base paper sheet, it is possible to obtain the sheet having viscosity and to suppress evaporation of water in the chemical solution. Furthermore, the base paper sheet (continuous sheet 1C) is in a state in which the content of CMC increase from inside towards the front surface and the back surface in the thickness direction of the base paper sheet. Therefore, when the base paper sheet is impregnated with the chemical solution containing a cross-linking agent, towards inside in the thickness direction, the cross-linking reaction is less likely to occur and voids increase. Accordingly, the chemical solution can be confined inside the sheet. In this way, it is possible to obtain the toilet cleaning sheet 100 that does not easily dry. Further, because a large quantity of cross-linking reactions of CMC occur in the vicinities of the external surfaces of the base paper sheet, it is possible to strengthen the surface strength of the obtained toilet cleaning sheet 100.

[0047] Specific descriptions have been provided above based on the embodiment of the present invention, but the present invention is not limited to the above described embodiment, and may be modified without departing from the scope of the invention. In the described embodiment of the present invention, an example is illustrated in which each of the embossments EM11 has the curved-shaped protruding part PR 21 and each of the embossments EM12 has the planar-shaped protruding part PR22, but the embossments are not necessarily limited to these shapes. For example, protruding parts of the embossments EM11 and the embossments EM12 may have planar shapes of differing heights. Alternatively, for example, each embossment EM11 may have a planar-shaped protruding part, and each embossment EM12 may have a curved-shaped protruding part.

[0048] In other words, a protruding part of each embossment may have any shape as long as two types of embossments (which are first embossments and second embossments) have protruding parts of different shapes and the second embossments are arranged around the first embossments.

[0049] Further, in the described embodiment of the present invention, the embossments EM12, each of which has the planar protruding part, are arranged between the embossments EM11, each of which has the curved surface protruding part, but the embossments EM11 may intersect with each other.

[0050] Further, in the described embodiment of the present invention, all the embossments EM11 and EM12 protrude towards the near side with respect to the drawing of FIG. 1, but embossments EM11 and EM12 having a convex shape towards the near side with respect to the drawing and embossments EM11 and EM12 having a concave shape towards the near side with respect to the drawing may be alternately arranged.

[0051] For example, as illustrated in FIG. 7, embossments EM11 and EM12 (portions illustrated by solid lines), each of which has a convex shape towards the near side with respect to the drawing of FIG. 7, and embossments EM11 and EM12 (portions illustrated by dashed lines), each of which has a concave shape with respect to the near side of the drawing of FIG. 7, may be alternately arranged to provide a household tissue that has high wiping performance for both surfaces of the toilet cleaning sheet 100 as well as enhancing surface strength of the household tissue by being embossed.

[0052] Further, in the described embodiment of the present invention, the protruding parts PR21 of the embossments EM11 and the protruding parts PR22 of the EM12 are close to cohere to be formed as the conjoined embossment EM21. However, the protruding parts PR21 of the embossments EM11 and the protruding parts PR22 of the EM12 may be simply close to each other without cohering.

[0053] Further, in the described embodiment of the present invention, an example is illustrated in which each embossment EM11 has a circular shape or an elliptical shape, but the shape of each embossment may be any shape, such as a rectangular shape or a polygonal shape.

[0054] Further, it is preferable that heights HT21 and HT22 of the protruding parts of the embossment EM11 and EM12 in FIG. 2 are 0.40 mm to 0.75 mm, for example.

It should be noted that the surfaces are three-dimensionally measured by a digital microscope made by KEYENCE Co. to measure the heights HT21 and HT22 of the protruding parts of the embossments EM11 and EM12, for example.

[0055] For example, when the heights are less than 0.40 mm, friction at the time of wiping becomes stronger and the wiping becomes difficult. When the heights exceed 0.75 mm, the shapes of the embossments EM11 and EM12 becomes easily deformed at the time of being packaged, and the appearance becomes worse.

[0056] Further, the embossed pattern is not limited to the above described pattern, but may be embossed patterns as illustrated in FIGS. 8 to 10. As illustrated in FIGS. 8 to 10, concave portions e2 have shapes obtained by inverting convex portions e1. The embossed pattern is formed such that the convex portions e1 and the concave portions e2 are alternately arranged in each of many lines and the convex portions e1 and the concave portions e2 in the adjacent lines are arrayed to be shifted with respect to each other by one-half pitch. In this way, by alternately forming the convex portions e1 and the concave portions e2 in both the longitudinal direction and the lateral direction, wiping performance of dirt can be enhanced relative to an embossed pattern in which convex portions are arranged in one line and convex portions are arranged in one line. It should be noted that the shapes of the convex portions e1 and the concave portions e2 are not particularly limited, and shapes such as circular shapes, elliptic shapes, and polygonal shapes may also be used. These shapes may be combined.

[Industrial Applicability]

[0057] The present invention is preferably applicable to a field of producing a hydrolysable sheet.

Description of Reference Symbols

[0058]

100	toilet cleaning sheet
1	primary web roller
1A	continuous dry base paper
1B	ply continuous sheet
1C	continuous sheet
1D	continuous hydrolysable sheet
1E	embossed sheet
2	overlapping part
3	spray nozzle
4	first drying facility
5	slitter
6	winder facility
11	secondary web roller
12	embossing roller
13	finishing facility
EM11	embossment
EM12	embossment
EM13	embossment
PR21	protruding part
PR22	protruding part

Claims

1. A hydrolysable sheet (100) obtained by impregnating a base paper sheet provided with a water-soluble binder, with a chemical solution, wherein
the base paper sheet is obtained by applying a ply process to a plurality of sheets of base paper and has a basis weight of from 30 gsm to 150 gsm,
the chemical solution contains a cross-linking agent, which causes the water-soluble binder to initiate a cross-linking reaction, and a polyhydric alcohol having three or more hydroxyl groups as a solvent, and with respect to a weight of the base paper sheet, the base paper sheet is impregnated with the polyhydric alcohol having three or more hydroxyl groups at 1% to 20% by weight **characterized in that**
said water-soluble binder includes a carboxyl group, a compounding ratio of softwood pulp to hardwood pulp in the base paper sheet is less than 1/1, and the base paper sheet is in a state in which a content of the water-soluble binder increases from inside towards a front surface and a back surface in a thickness direction of the base paper sheet.

2. The hydrolysable sheet according to claim 1, wherein with respect to a weight of the base paper sheet, the base paper sheet is impregnated with the chemical solution at 150% to 300% by weight.

3. The hydrolysable sheet according to claim 1 or 2, wherein said polyhydric alcohol is glycerin or sorbitol.

4. The hydrolysable sheet according to any one of claims 1 to 3, wherein embossments are formed on an entire surface of the hydrolysable sheet.

5. The hydrolysable sheet according to claim 4, wherein the embossments include first embossments and second embossments arranged around the first embossments, a shape of a protruding part of each of the second embossments differing from a shape of a protruding part of each of the first embossments.

6. The hydrolysable sheet according to claim 5, wherein the first embossments are arrayed in a rhomboid grid.

7. The hydrolysable sheet according to claim 5 or 6, wherein each of the second embossments is arrayed between two of the first embossments.

8. The hydrolysable sheet according to any one of claims 5 to 7, wherein the first embossments contact

the second embossments to form a conjoined embossment.

9. The hydrolysable sheet according to any one of claims 1 to 8, wherein a compounding proportion of softwood pulp to the components of fiber material is greater than 50% by weight.

10. The hydrolysable sheet according to any one of claims 1 to 9, wherein the binder contains carboxymethyl cellulose.

11. Method for producing a hydrolysable sheet according to any one of claims 1 to 10 comprising:

- applying a ply process to a plurality of sheets of base paper (1A) having a compounding ratio of softwood to hardwood of less than 1/1 to form a plied continuous sheet (1B);
- spraying a solution comprising binder including a carboxyl group is to the plied continuous sheet from respective two-fluid-type spray nozzles (3) on both external surfaces of the plied continuous sheet (1B)
- impregnating the plied continuous sheet (1B) in a chemical solution containing a cross-linking agent, which causes the water-soluble binder to initiate a cross-linking reaction, and a polyhydric alcohol having three or more hydroxyl groups as a solvent.

Patentansprüche

1. Hydrolysierbares Blatt (100), das durch Imprägnieren eines Rohpapierblatts, das mit einem wasserlöslichen Binder versehen ist, mit einer chemischen Lösung erhalten wird, wobei
das Rohpapierblatt durch Anwenden eines Faltprozesses auf eine Mehrzahl von Blättern von Rohpapier erhalten wird und ein Flächengewicht von 30 gsm bis 150 gsm aufweist,
die chemische Lösung ein Vernetzungsmittel, das den wasserlöslichen Binder zum Auslösen einer Vernetzungsreaktion veranlasst, und einen mehrwertigen Alkohol mit drei oder mehr Hydroxylgruppen als Lösungsmittel enthält, und
die Imprägnierung des Rohpapierblatts mit dem mehrwertigen Alkohol mit drei oder mehr Hydroxylgruppen 1 Gewichts% bis 20 Gewichts% in Bezug auf ein Gewicht des Rohpapierblatts beträgt, **dadurch gekennzeichnet, dass**
der wasserlösliche Binder eine Carboxylgruppe umfasst, ein Mischverhältnis von Weichholzzellstoff zu Hartholzzellstoff im Rohpapierblatt weniger als 1:1 beträgt, und das Rohpapierblatt in einem Zustand ist, in welchem ein Gehalt des wasserlöslichen Binders von innen zu einer vorderen Fläche und einer hinteren Fläche in einer Dickenrichtung des Rohpapierblatts zunimmt.

2. Hydrolysierbares Blatt nach Anspruch 1, wobei die Imprägnierung des Rohpapierblatts mit der chemischen Lösung 150 Gewichts% bis 300 Gewichts% in Bezug auf ein Gewicht des Rohpapierblatts beträgt.

3. Hydrolysierbares Blatt nach Anspruch 1 oder 2, wobei der mehrwertige Alkohol Glycerin oder Sorbitol ist.

4. Hydrolysierbares Blatt nach einem der Ansprüche 1 bis 3, wobei Prägungen auf der gesamten Oberfläche des hydrolysierbaren Blatts ausgebildet sind.

5. Hydrolysierbares Blatt nach Anspruch 4, wobei die Prägungen erste Prägungen und zweite Prägungen umfassen, die um die ersten Prägungen angeordnet sind, wobei sich eine Form eines vorstehenden Teils jeder der zweiten Prägungen von einer Form eines vorstehenden Teils einer jeden der ersten Prägungen unterscheidet.

6. Hydrolysierbares Blatt nach Anspruch 5, wobei die ersten Prägungen in einem Rautengitter angeordnet sind.

7. Hydrolysierbares Blatt nach Anspruch 5 oder 6, wobei jede der zweiten Prägungen zwischen zweien der ersten Prägungen angeordnet ist.

8. Hydrolysierbares Blatt nach einem der Ansprüche 5 bis 7, wobei die ersten Prägungen die zweiten Prägungen berühren, um eine verbundene Prägung zu bilden.

9. Hydrolysierbares Blatt nach einem der Ansprüche 1 bis 8, wobei ein Mischverhältnis von Weichholzzellstoff zu den Fasermaterialkomponenten größer als 50 Gewichts% ist.

10. Hydrolysierbares Blatt nach einem der Ansprüche 1 bis 9, wobei der Binder Carboxymethylcellulose enthält.

11. Verfahren zur Herstellung eines hydrolysierbaren Blatts nach einem der Ansprüche 1 bis 10, umfassend:

- Anwenden eines Faltprozesses auf eine Mehrzahl von Blättern von Rohpapier (1A) mit einem Mischverhältnis von Weichholz zu Hartholz von weniger als 1:1, um ein gefaltetes Endlosblatt (1B) zu bilden;
- Sprühen einer Lösung mit Binder, der eine Carboxylgruppe umfasst, aus jeweiligen Zweistoff-

Sprühdüsen (3) auf beiden Außenflächen des Endlosblatts (1B) auf das gefaltete Endlosblatt;
- Imprägnieren des Endlosblatts (1B) mit einer chemischen Lösung, das ein Vernetzungsmittel, das den wasserlöslichen Binder zum Auslösen einer Vernetzungsreaktion veranlasst, und einen mehrwertigen Alkohol mit drei oder mehr Hydroxylgruppen als Lösungsmittel aufweist.

Revendications

1. Feuille hydrolysable (100) obtenue par imprégnation d'une feuille de papier de base fournie avec un liant hydrosoluble, avec une solution chimique, dans laquelle
la feuille de papier de base est obtenue par application d'un procédé en couches à une pluralité de feuilles de papier de base et a un poids de base de 30 gsm à 150 gsm,
la solution chimique contient un agent de réticulation, qui provoque l'initiation d'une réaction de réticulation par le biais du liant hydrosoluble, et un polyol ayant trois groupes hydroxyle ou plus en tant que solvant, et
en ce qui concerne un poids de la feuille de papier de base, la feuille de papier de base est imprégnée avec le polyol ayant trois groupes hydroxyle ou plus à hauteur de 1 % à 20 % en poids **caractérisée en ce que**
ledit liant hydrosoluble comprend un groupe carboxyle, un rapport de mélange de la pâte de bois tendre à la pâte de bois dur dans la feuille de papier de base est inférieur à 1/1, et la feuille de papier de base est dans un état dans lequel une teneur en liant hydrosoluble augmente de l'intérieur vers une surface avant et une surface arrière dans un sens de l'épaisseur de la feuille de papier de base.

2. Feuille hydrolysable selon la revendication 1, dans laquelle en ce qui concerne un poids de la feuille de papier de base, la feuille de papier de base est imprégnée avec la solution chimique à hauteur de 150 % à 300 % en poids.

3. Feuille hydrolysable selon la revendication 1 ou 2, dans laquelle ledit polyol est de la glycérine ou du sorbitol.

4. Feuille hydrolysable selon l'une quelconque des revendications 1 à 3, dans laquelle des gaufrages sont formés sur toute une surface de la feuille hydrolysable.

5. Feuille hydrolysable selon la revendication 4, dans laquelle les gaufrages comprennent des premiers gaufrages et des seconds gaufrages agencés autours des premiers gaufrages, une forme d'une partie en saillie de chacun des seconds gaufrages étant différente d'une forme d'une partie en saillie de chacun des premiers gaufrages.

6. Feuille hydrolysable selon la revendication 5, dans laquelle les premiers gaufrages sont disposés en réseau dans une grille rhomboïde.

7. Feuille hydrolysable selon la revendication 5 ou 6, dans laquelle chacun des seconds gaufrages est disposé en réseau entre deux des premiers gaufrages.

8. Feuille hydrolysable selon l'une quelconque des revendications 5 à 7, dans laquelle les premiers gaufrages sont en contact avec les seconds gaufrages pour former un gaufrage conjoint.

9. Feuille hydrolysable selon l'une quelconque des revendications 1 à 8, dans laquelle une proportion de mélange de la pâte de bois tendre par rapport aux composants de matière fibreuse est supérieure à 50 % en poids.

10. Feuille hydrolysable selon l'une quelconque des revendications 1 à 9, dans laquelle le liant contient de la carboxyméthylcellulose.

11. Procédé de production d'une feuille hydrolysable selon l'une quelconque des revendications 1 à 10 comprenant :

- l'application d'un procédé en couches à une pluralité de feuilles de papier de base (1A) ayant un rapport de mélange de la pâte de bois tendre à la pâte de bois dur inférieur à 1/1 pour former une feuille continue épaisse (1B) ;
- la pulvérisation d'une solution comprenant un liant incluant un groupe carboxyle sur la feuille continue épaisse à partir de deux buses de pulvérisation de type fluide (3) sur les deux surfaces externes de la feuille continue épaisse (1B) ;
- l'imprégnation de la feuille continue épaisse (1B) dans une solution chimique contenant un agent de réticulation, qui provoque l'initiation d'une réaction de réticulation par le biais du liant hydrosoluble, et un polyol ayant trois groupes hydroxyle ou plus en tant que solvant.

FIG.1

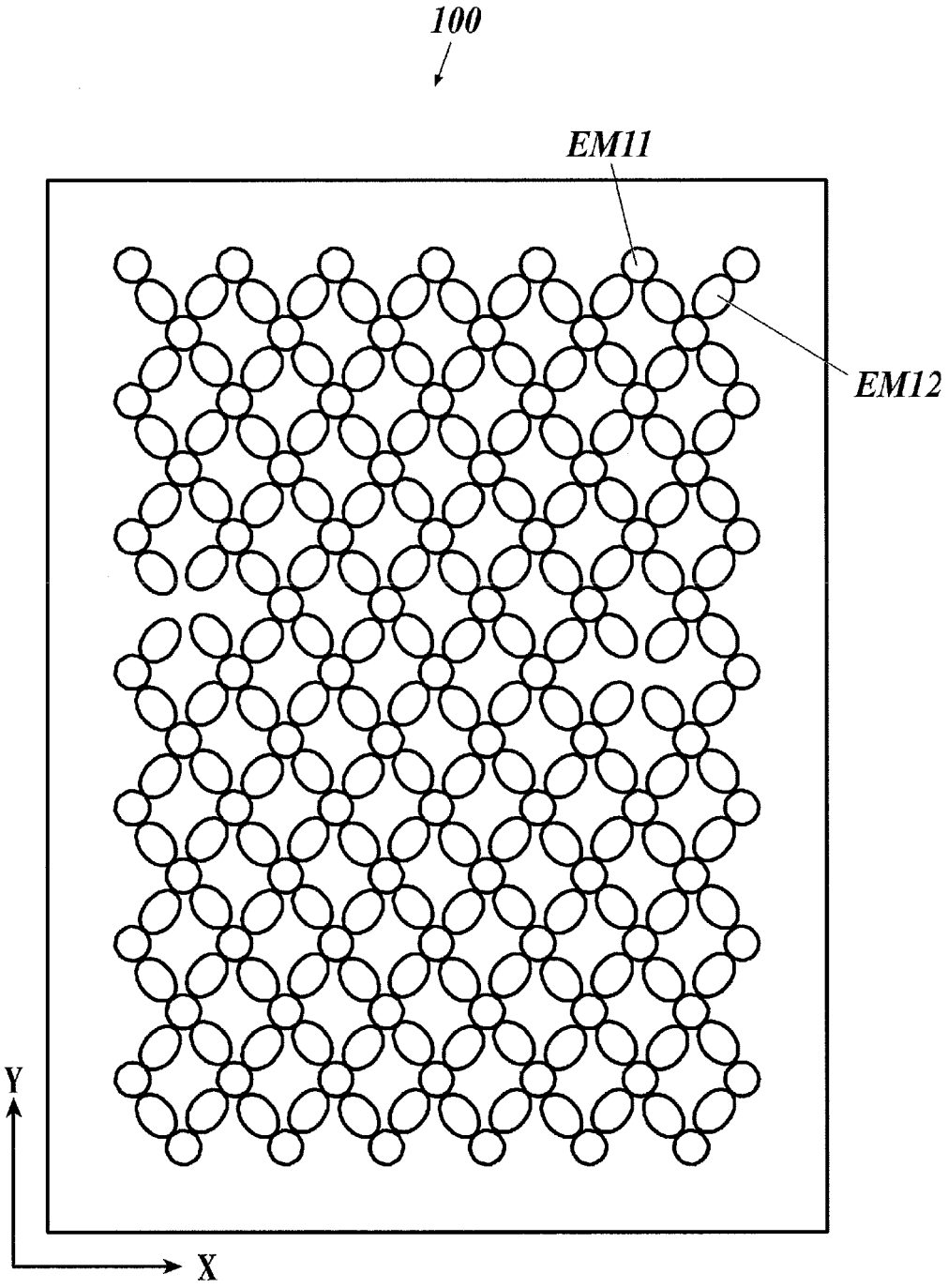


FIG.2A

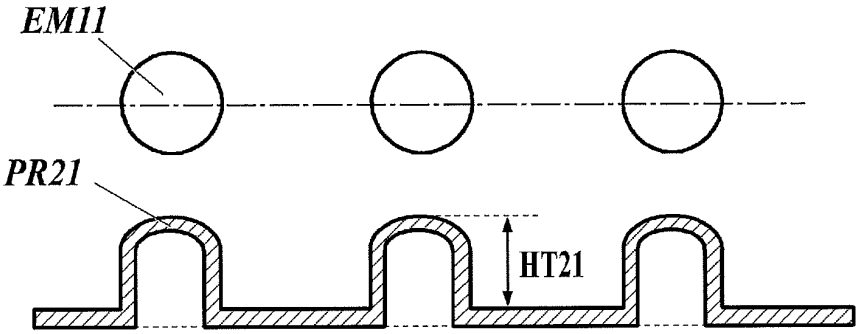


FIG.2B

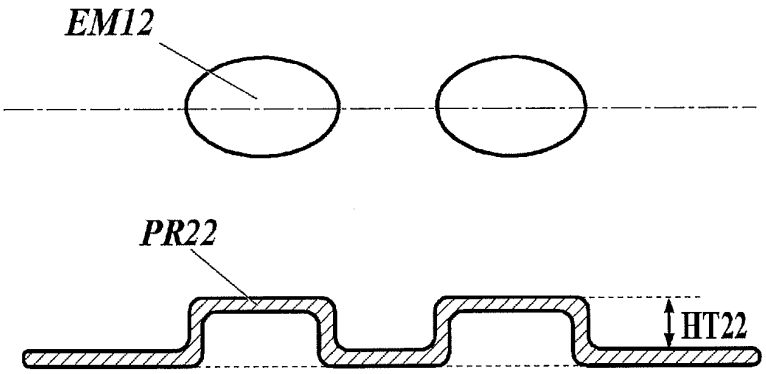


FIG.2C

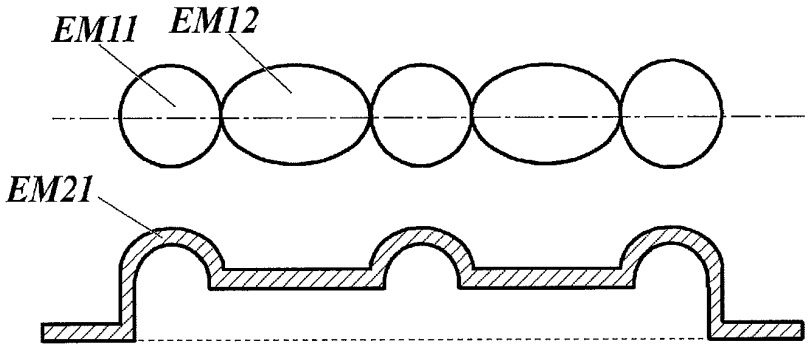


FIG.3A

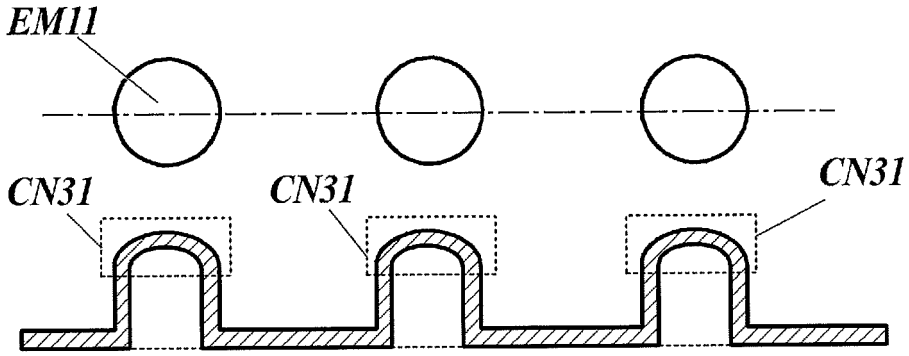


FIG.3B

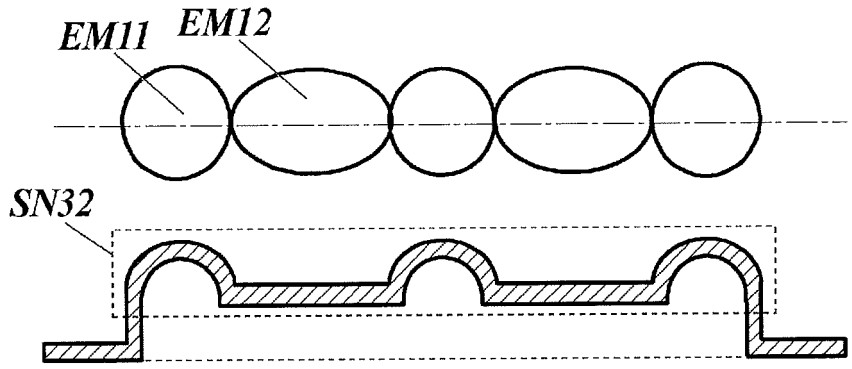


FIG.4

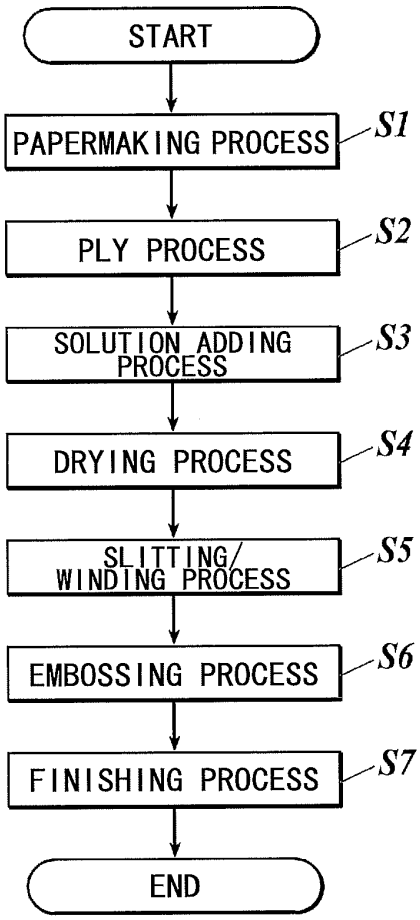


FIG.5

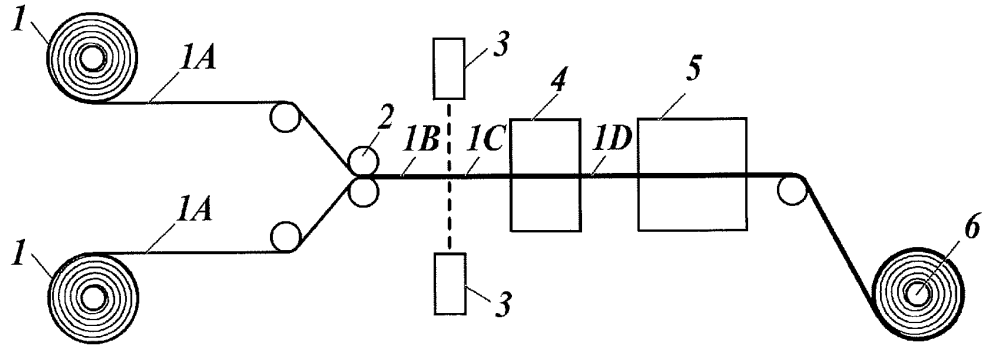


FIG.6

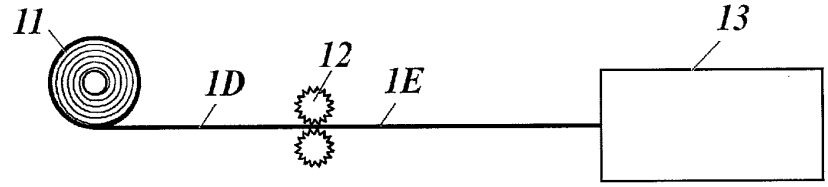


FIG.7

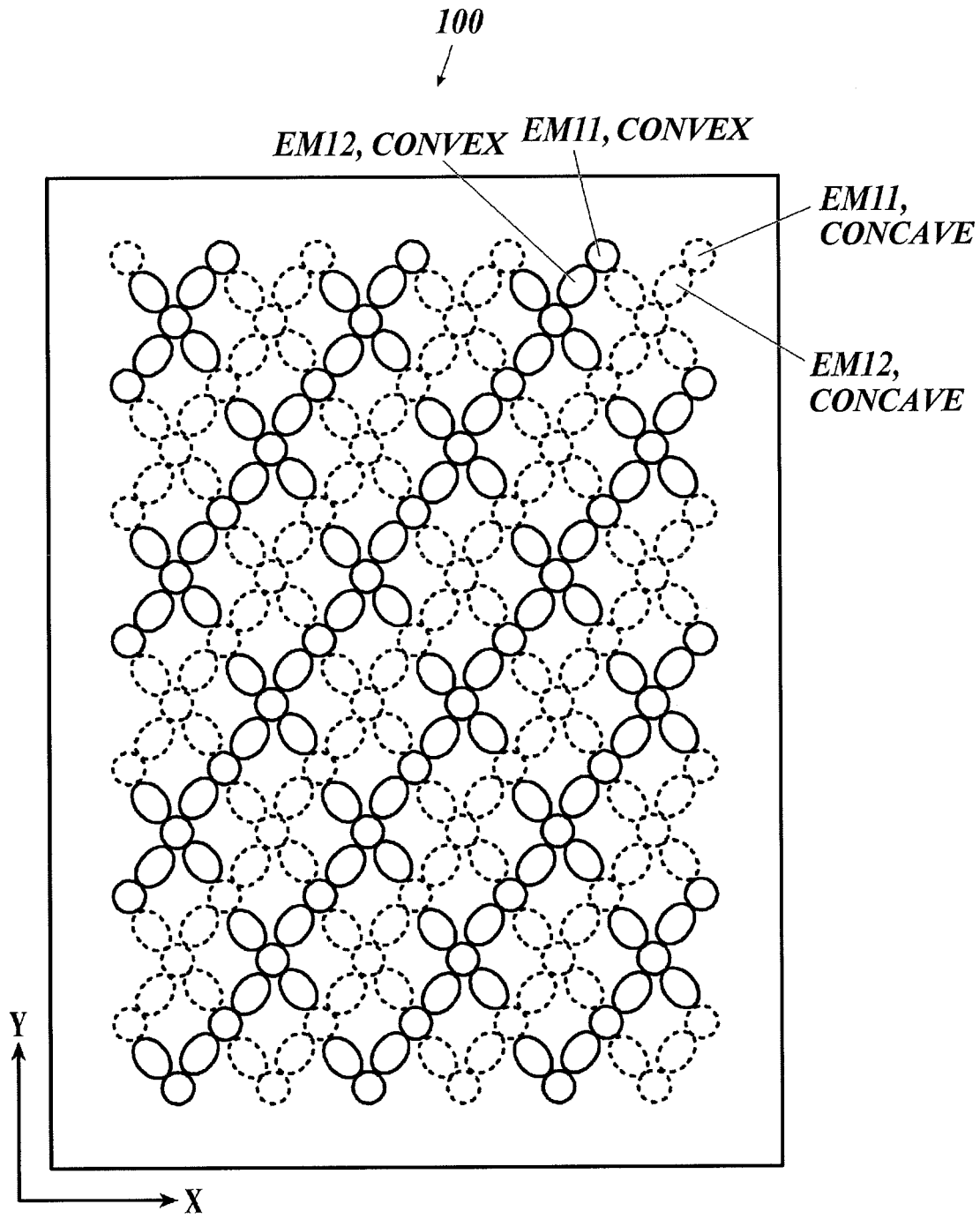


FIG.8

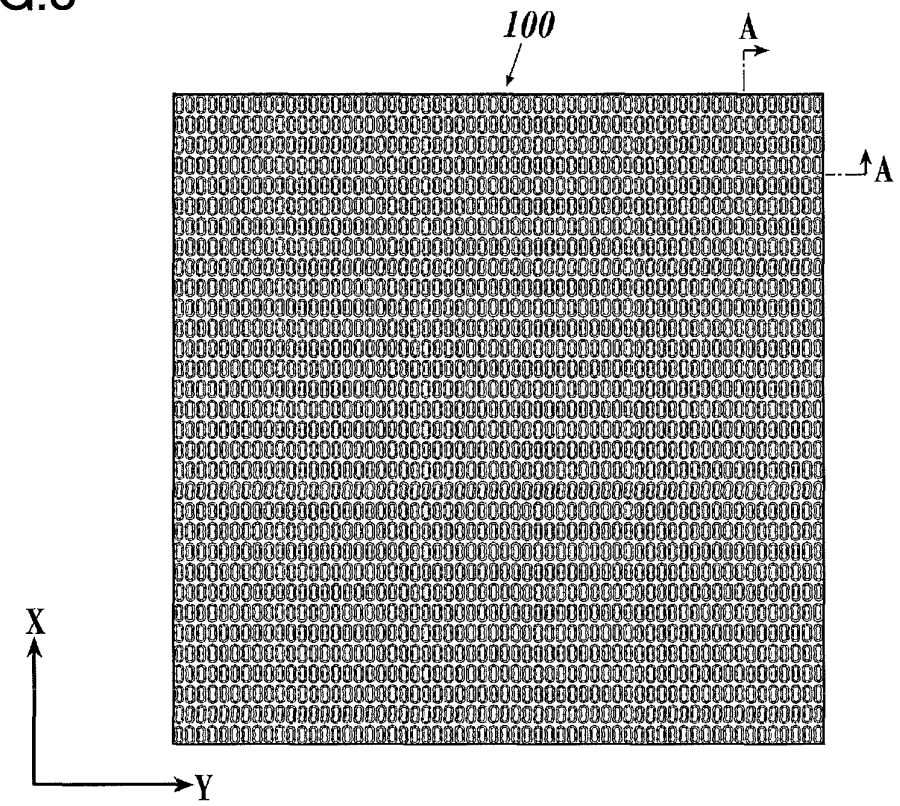


FIG.9

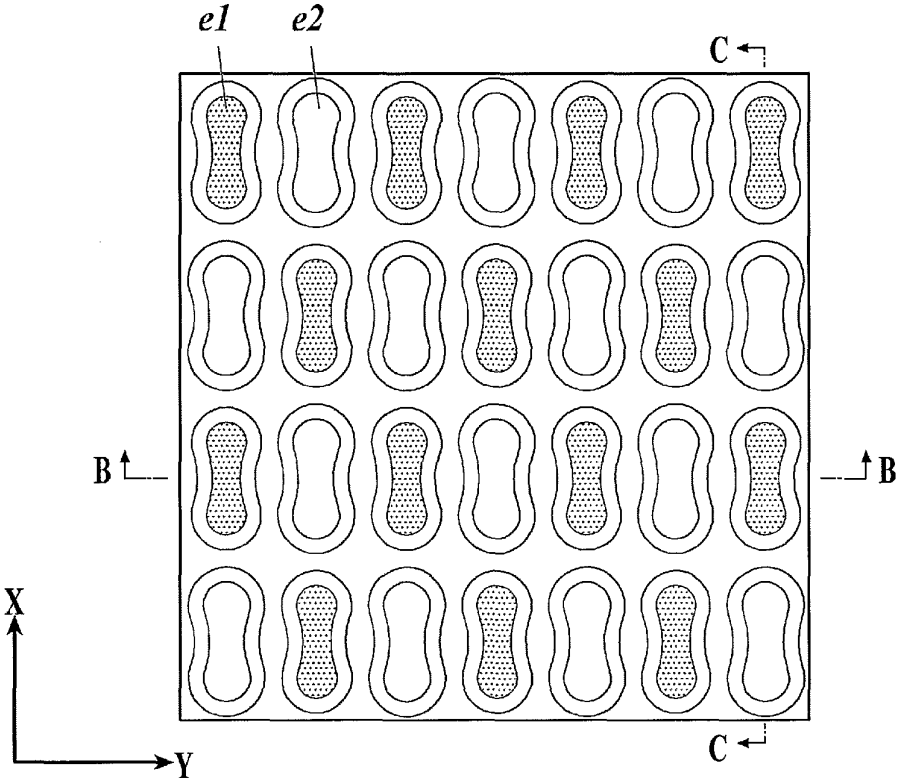
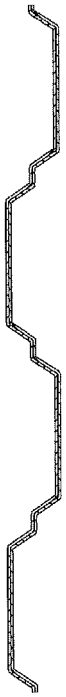


FIG.10A

FIG.10B



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- JP 2011030793 A **[0002]**
- EP 1630288 A1 **[0002]**